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Bonnie S. Gerner

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

Applicant:	Donald B. Appleby et al	:	Paper No.:
Serial No.:	08/360,184	:	Group Art Unit: 1623
Filing Date:	December 20, 1994	:	Examiner: E. White
FOR:	**POLYOL POLYESTER SYNTHESIS**		

TRANSMITTAL OF APPEAL BRIEF

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Submitted herewith in **triplicate** is an Appeal Brief in support of the Notice of Appeal filed December 13, 2004 and received December 16, 2004. Please charge the amount of $500.00 for payment of the government fee for filing the present Appeal Brief to our Visa credit card account. Form PTO-2038 is attached.

Please charge any additional fees required or credit any excess in fees paid in connection with the present communication to Deposit Account No. 04-1133.

Respectfully submitted,

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Serial No.:	08/360,184	:	Group Art Unit:	1623
Filing Date:	December 20, 1994	:	Examiner:	E. White

For: **Polyol Polyester Synthesis**

APPEAL BRIEF

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The present Appeal Brief is submitted in support of the Notice of Appeal filed by Certificate of Mail on December 13, 2004 and received by the U.S. Patent and Trademark Office on December 16, 2004.

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is the assignee of the present application, The Procter & Gamble Company.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to the Appellants, the Appellants' undersigned legal representative or the assignee which will directly effect or be directly

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effected by or having a bearing on the Board's decision in the present appeal. However, Appellants note that a Request for Interference with U.S. Patent No. 5,043,438 was filed in this application on April 19, 1999 and remains before the Examiner for consideration.

III. STATUS OF THE CLAIMS

Claims 1, 5, 6, 8, 9, 13-15, 23, 27, 28, 30, 43-45, 48, 51, 54, 55 and 62-118 are pending in this application. Claims 63-118 have been allowed. Claims 1, 5, 6, 8, 9, 13-15, 23, 27, 28, 30, 43-45, 48, 51, 54, 55 and 62 stand rejected and are the subject of the present appeal. Claims 2-4, 7, 10-12, 16-22, 24-26, 29, 31-42, 46, 47, 49, 50, 52, 53 and 56-61 have been cancelled. A copy of the appealed claims is set forth in the Appendix.

IV. STATUS OF AMENDMENT FILED SUBSEQUENT TO REJECTION ON APPEAL

No amendment was filed subsequent to the final rejection set forth in the Official Action dated July 12, 2004.

V. SUMMARY OF THE INVENTION

The present invention is directed to processes for the improved synthesis of higher polyol fatty acid polyesters using transesterification reactions that do not employ a solvent to form a homogeneous reaction mix, and particularly relates to continuous processes for such improved synthesis (page 1, lines 13-19).

According to claim 1, the invention is directed to a continuous process for preparing highly esterified polyol fatty-acid polyester by interesterifying polyol containing more than about four esterifiable hydroxy groups and fatty-acid ester of easily removable alcohol in a heterogeneous reaction mixture. A catalyst is used in the reaction mixture at an initial level of from about 0.01 to about 0.5 mole of catalyst per mole of polyol; and a soap emulsifier is

used in the initial stage of the process at a level of from about 0.001 to about 0.6 mole of soap per mole of polyol. The molar ratio of total ester reactant to each esterifiable hydroxy group of the polyol in the reaction mixture ranges from about 0.9:1 to about 1.2:1. The temperature in the initial stage of the process ranges from about 130°C to about 140°C, and in the final stages of the process ranges from about 80°C to about 120°C; and easily removable alcohol is removed from the reaction mixture as the interesterifying reaction proceeds. The initial stage of the interesterifying reaction is carried out in a continuous manner under conditions of backmixing suitable for maintaining within the reaction mixture a level of lower partial fatty acid esters of the polyol that is sufficient to emulsify the reaction mixture.

Claims 5, 6, 8, 9, 13 and 23 depend from claim 1. According to claims 5 and 6, the initial catalyst level is from about 0.01 to about 0.1 mole, and from about 0.02 to about 0.05 mole, respectively, of catalyst per mole of polyol. According to claim 8, the initial level of soap emulsifier is from about 0.2 to about 0.4 mole per mole of polyol. According to claim 9, the soap emulsifier of claim 8 is a potassium soap of hydrogenated fatty acid containing from about 10 to about 22 carbon atoms.

Claim 13 recites that the molar ratio of the total ester reactant to the esterifiable hydroxyl group is from about 1:1 to about 1.2:1. According to claim 23, the temperature in the initial stage is between about 132°C and about 135°C.

Claim 62 is in Jepson form and recites a continuous process for preparing highly esterified polyol fatty acid polyester by interesterifying polyol containing more than four esterifiable hydroxyl groups and fatty acid ester of an easily removable alcohol in a heterogeneous reaction mixture wherein the easily removable alcohol is removed from the reaction mixture as the reaction proceeds. Claim 62 recites that the improvement comprises carrying out an initial stage of the interesterifying reaction in a continuous manner under conditions of backmixing suitable for maintaining within the reaction mixture a level of

lower partial fatty acid esters of the polyol that is sufficient to emulsify the reaction mixture; and carrying out at least a final stage of the interesterifying reaction in a continuous manner under conditions approaching plug-flow conditions after the degree of esterification of the polyol has reached at least about 50%.

Claims 14, 15, 27, 28, 30, 43-45, 48, 51, 54 and 55 depend from claim 62. According to claims 14 and 15, the initial stage of the interesterifying reaction is carried out under conditions of backmixing until the average degree of esterification of the polyol is from about 20% to about 70%, and from about 35% to about 60%, respectively, to thereby provide sufficient lower partial polyol polyester to aid in solubilization of the polyol.

Claim 27 recites that in the initial stage of the interesterifying reaction, the reaction mixture contains soap emulsifier at a level of from about 0.001 to about 0.6 mole per mole of polyol, while claim 28 further recites that the soap emulsifier is at a level of from about 0.2 to about 0.4 mole per mole of polyol and the conditions of backmixing are continued until the degree of esterification of the polyol is from about 30% to about 60%.

According to claim 30, the temperature in the initial stage is from about 132°C to about 135°C and the temperature in the subsequent stages is from about 100°C to about 120°C.

Claim 43 recites that the molar ratio of the total ester reactant to each said esterifiable hydroxyl group is from about 1:1 to about 1.2:1. According to claim 44, the final degree of esterification of the polyol reaches at least about 70%, while claim 45 further recites that the final average degree of esterification of the polyol is at least about 95%.

Claim 48 recites that the final stages of the reaction are carried out under plug-flow conditions, after the degree of esterification of the polyol has reached at least about 50%, while claim 51 further recites that the molar ratio of the total ester reactant to each esterifiable hydroxyl group of the polyol is from about 1:1 to about 1.2:1.

Finally, according to claim 54, the process is carried out in a series of at least two reaction vessels, while according to claim 55, there are from three to about eight of said reaction vessels.

VI. ISSUE ON APPEAL

The single issue on appeal is the rejection of claims 1, 5, 6, 8, 9, 13-15, 23, 27, 28, 30, 43-45, 48, 51, 54, 55 and 62 under 35 U.S.C. §103(a) as being unpatentable over the Willemse U.S. Patent No. 4,973,682 (Willemse '682) or the Volpenhein U.S. Patent No. 4,517,360, in view of the Willemse European Reference EP 349 059 (Willemse EP '059), the Balint et al U.S. Patent No. 3,689,461 (Balint et al '461), the Balint et al U.S. Patent No. 3,679,368 (Balint et al '368), the Seltzer U.S. Patent No. 3,567,369 or the Mansour U.S. Patent No. 4,449,828.

VII. GROUPING OF THE CLAIMS

With respect to the above-noted issue on appeal, Appellants concede that claims 5, 6, 23, 27, 44 and 45 stand or fall with claim 1 or claim 62 from which they respectively depend. However, Appellants submit that claims 8, 9, 13-15, 28, 30, 43, 48, 51, 54 and 55 are independently patentable from claim 1 or claim 62 from which they respectively depend. Reasons in support of the independent patentability of these claims are set forth below.

VIII. ARGUMENTS

Appellants submit that the processes defined by independent claims 1 and 62, and claims 5, 6, 8, 9, 13-15, 23, 27, 28, 30, 43-45, 48, 51, 54 and 55 dependent thereon, are nonobvious over and patentably distinguishable from the combination of references cited by

the Examiner. Accordingly, the rejection under 35 U.S.C. §103(a) should be reversed, and favorable action by the Board is respectfully requested.

A. The Examiner's Position

As noted above, the claims on appeal were rejected under 35 U.S.C. §103(a) as being unpatentable over Willemse '682 or Volpenhein in view of Willemse EP '059, Balint et al '461, Balint et al '368, Seltzer or Mansour. The Examiner asserted that Willemse '682 discloses a process for the synthesis of polyol fatty acid polyesters comprising a two-stage transesterification of polyol to polyester wherein the polyol is esterified to a degree of conversion within the range of 10-50% substantially without leaving non-participating polyol, and in a subsequent final stage, the reaction is caused to proceed to a degree of conversion of at least 70%. The Examiner noted the molar ratio of fatty acid lower-alkyl ester: sucrose, the molar ratio of catalyst:polyol, alkali metal soaps, transesterification reaction temperatures, reaction vessels and removal of lower-alkyl alcohol disclosed by Willemse. The Examiner also asserted that Willemse suggests that the process can be carried out in a continuous or semi-continuous operation. Further, the Examiner asserted that Volpenhein discloses a transesterification process for synthesizing polyol fatty acid polyesters and that the process disclosed by Volpenhein is within the scope of the process set forth in the instant claims.

The Examiner relied on Willemse EP '059 as disclosing a process for the synthesis of polyol fatty acid polyesters in which at least during the final stage of the transesterification reaction, the reaction mixture is submitted to the action of a stripping agent suitable for accelerating the removal of a lower alkyl alcohol formed in the reaction. The Examiner asserted that the Balint et al '461 reference discloses a process for the preparation of linear condensation polyesters in a continuous or discontinuous process and that Fig. 1 suggests plug flow conditions. The Examiner asserted that the Balint et al '368 reference, Seltzer and

Mansour all show that the preparation of products in a continuous operation under conditions of backmixing and plug flow is well known in the art. The Examiner concluded it would have been obvious to modify the Willemse '682 and Volpenhein processes by applying the various conditions under which the process is to be carried out as suggested by Willemse EP '059 and Balint et al '461, Balint et al '368, Seltzer and Mansour.

B. Claims 1 and 62 are Nonobvious

The processes defined by claims 1 and 62 are nonobvious over and patentably distinguishable from the cited combination of references.

As defined by claim 1, the invention is directed to a continuous process for preparing highly esterified polyol fatty-acid polyester by interesterifying polyol containing more than about four esterifiable hydroxy groups and fatty-acid ester of easily removable alcohol in a heterogeneous reaction mixture. A combination of reaction conditions is specified. Namely, the catalyst is used in the reaction mixture at an initial level of from about 0.01 to about 0.5 mol of catalyst per mol of polyol, a soap emulsifier is used in the initial stage of the process at a level of from about 0.001 to about 0.6 mol of soap per mol of polyol, the molar ratio of total ester reactant to each esterifiable hydroxy group of the polyol in the reaction mixture range is from about 0.9:1 to about 1.2:1, the temperature in the initial stage of the process ranges from about 130°C to about 140°C, and in the final stages of the process ranges from about 80°C to about 120°C, and easily removable alcohol is removed from the reaction mixture as the interesterifying reaction proceeds. Additionally, the initial stage of the interesterifying reaction is carried out in a continuous manner under conditions of backmixing suitable for maintaining within the reaction mixture a level of lower partial fatty acid esters of polyol that is sufficient to emulsify the reaction mixture.

Appellants have discovered that this combination of reaction parameters provides a fast reaction, obtains highly esterified product in high yields, and minimizes the amounts of

unwanted impurities and by products. Thus, the claimed processes are suitable for large scale, commercial production.

Claim 62 is in Jepson format and recites a continuous process for preparing highly esterified polyol fatty acid polyester by interesterifying polyol containing more than four esterifiable hydroxy groups and fatty acid ester of an easily removable alcohol in a heterogeneous reaction mixture wherein the easily removable alcohol is removed from the reaction mixture as the reaction proceeds. The improvement comprises carrying out an initial stage of the interesterifying reaction in a continuous manner under conditions of backmixing suitable for maintaining within the reaction mixture a level of lower partial fatty acid esters of the polyol that is sufficient to emulsify the reaction mixture, and carrying out at least a final stage of the interesterifying reaction in a continuous manner under conditions approaching plug-flow conditions after the degree of esterification of the polyol has reached at least about 50%.

As set forth in the present specification, for example at page 1, lines 13-19, and as demonstrated in the examples in the present application, the presently claimed processes provide a continuous process that is capable of making the desired polyol fatty acid polyesters of improved quality and in an efficient manner. As set forth in the specification, for example beginning at page 19, line 3, it is desirable to conduct the initial stage or stages of the reaction in a continuous manner and under backmixing conditions to maintain the degree of esterification in a desired range, which, in turn, provides both sufficient lower partial polyol polyester to aid in the solubilization of a poorly soluble polyol reactant and a stable heterogeneous reaction mixture that minimizes unreacted polyol, while preventing overfoaming. As set forth at page 19, lines 15-19, the combination of backmixing conditions with a continuous reaction allows individual reactants to be added to the first stage at a rate that maintains the desired degree of esterification and yet provides sufficient yield from the

first stage to maintain the reaction in subsequent stages. Further, conducting the final stages under conditions of plug flow as required by claim 62 allows more efficient processing under stringent and costly conditions, for example, lower pressures and higher sparge rates, while achieving high degrees of esterification in the final product, as demonstrated, for example in Examples 12 and 16.

As noted by the Examiner, both Willemse '682 and Volpenhein disclose methods for synthesis of polyol fatty acid polyesters by transesterification of polyol with fatty acid ester reactant. Willemse '682 is particularly directed to controlling the partial vapor pressure of lower-alkyl alcohol formed during the transesterification reaction such that the reaction cannot proceed beyond a degree of conversion which corresponds to esterification to the polyol monoester and/or oligoesters (column 2, lines 11-18). While Willemse '682 indicates at column 5, lines 66-68 that in a continuous or semi-continuous operation, the drying chamber and reaction vessel preferably are separate, Appellants find no other teaching or suggestion in Willemse '682 relating to a continuous process. Particularly, Appellants find no teaching or suggestion in Willemse '682 relating to a continuous process carried out under conditions of backmixing, and, specifically, under conditions of backmixing suitable for maintaining within a reaction mixture a level of lower partial fatty acid esters of polyol that is sufficient to emulsify the reaction mixture as recited in claims 1 and 62. Moreover, Appellants find no teaching or suggestion in Willemse '682 that in such a continuous process, at least a final stage of the interesterifying reaction should be conducted under conditions approaching plug-flow conditions, particularly after the degree of esterification of the polyol has reached at least about 50%, as required by claim 62. To the contrary, the specific exemplary teachings of Willemse '682 are directed to batch processes.

Volpenhein is specifically directed to an improved transesterification process wherein a basic catalyst component selected from the group consisting of potassium carbonate,

sodium carbonate, barium carbonate and mixtures thereof is employed. However, Appellants find no teaching or suggestion by Volpenhein relating to a continuous process. Further, Appellants find no teaching or suggestion by Volpenhein relating to a continuous process wherein an initial stage of the reaction is carried out in a continuous manner under conditions of backmixing or, more specifically, under conditions of backmixing suitable for maintaining within the reaction mixture a level of lower partial fatty acid esters of the polyol that is sufficient to emulsify the reaction mixture as required by claims 1 and 62. Similarly, Appellants find no teaching or suggestion by Volpenhein of such a process wherein at least a final stage of the interesterifying reaction is carried out in a continuous manner under conditions approaching plug-flow conditions after the degree of esterification of the polyol has reached at least about 50%, as further required by claim 62. To the contrary, the specific exemplary teachings of Volpenhein are directed to batch processes.

Further, Appellants find no teaching or suggestion by Willemse '682 or Volpenhein of the combination of reaction conditions recited in claim 1. For example, the combination of reaction conditions specified in claim 1 requires that the temperature in the initial stage of the process ranges from about 130°C to about 140°C and in the final stages of the process ranges from about 80°C to about 120°C. As set forth in the present specification, for example at page 18, beginning at line 6 and in Examples 4 and 16, the lower temperature in the later stage of the reaction has surprisingly been found to minimize undesirable side reactions. The speed of the reaction, surprisingly, can be maintained by control of other reaction parameters, for example improved removal of the lower alcohol.

Appellants find no teaching or suggestion by either Willemse '682 or Volpenhein in this regard. To the contrary, , Willemse '682 discloses slightly raising the temperature during the later stage of the transesterification reaction (column 3, lines 52-54). Similarly, Volpenhein discloses that after the excess ester is added to the reaction mixture in stage two,

the mixture is heated to a temperature of from about 120°C to about 160°C, preferably about 135°C (column 5, lines 53-57). Thus, these references teach away from the temperature parameter required by claim 1 as Willemse '682 discloses raising the temperature in the later stage of the reaction, rather than reducing the temperature as required by claim 1, while Volpenhein does not distinguish between the temperature employed in his reaction steps. It is error to find obviousness where references diverge from and teach away from the invention at hand, *In re Fine*, 5 U.S.P.Q. 2d 1596, 1599 (Fed. Cir. 1988). Thus, the Examiner is in error in asserting that Willemse '682 and/or Volpenhein discloses the reaction conditions of present claim 1.

Moreover, claim 1 requires that the molar ratio of total ester reactant to each esterifiable hydroxy group of the polyol in the reaction mixture ranges from about 0.9:1 to about 1.2:1. In contrast, Willemse '682 discloses a fatty acid lower-alkyl ester:sucrose molar ratio lower limit of 10:1 (column 4, lines 37-41). Recognizing that sucrose has 8 esterifiable hydroxy groups, the disclosed molar ratio lower limit is 1:25 (10/8), above that required by claim 1. Volpenhein on the other hand merely discloses the weight percentages of polyol and fatty acid esters as in the ranges of 10% to about 50% by weight polyol and from about 40% to about 80% by weight of the fatty acid ester, without specifying molar ratios for step 1 (column 4, line 65 - column 5, line 7). The only teaching specifically directed to molar ratios of the reactant throughout the process is in Example 1 wherein the final molar ratio of fatty acid methyl ester to sucrose was 12:1. Again, recognizing that sucrose has 8 esterifiable hydroxy groups, this corresponds to a fatty acid: hydroxyl group ratio of 1.5:1, again above the range recited in claim 1. Thus, the teachings of Willemse '682 and Volpenhein are further deficient in disclosing the reaction conditions of claim 1.

Moreover, the deficiencies of Willemse '682 and Volpenhein are not resolved by Willemse EP '059, Balint et al, Seltzer or Mansour. First, Appellants note that Willemse EP

'059 is not proper prior art with respect to the present application. That is, the present application has an effective U.S. filing date of September 11, 1990. However, as set forth in the showing under 37 C.F.R. §1.608(b) in support of the Request for Interference Under 37 C.F.R. §1.607 filed April 19, 1999, the present invention was reduced practice at least as early as January 20, 1989 and was not abandoned, suppressed or concealed between the reduction to practice in January 1989 and the filing of the original parent application on September 11, 1990. In contrast, the effective date of Willemse EP '059 under 35 U.S.C. §102(a) is its publication date of January 3, 1990, subsequent to the reduction to practice of the present invention. Thus, EP '059 is not proper prior art with respect to the present application.

Moreover, Willemse EP '059 does not provide any teaching or suggestion for resolving the above-noted deficiencies of Willemse '682 and Volpenhein. While Willemse EP '059, like Willemse '682, briefly indicates that in a continuous or semi-continuous operation, the drying chamber and reaction vessel preferably are separate (page 4, lines 46-47), Appellants find no teaching or suggestion in this reference relating to continuous processes as recited in claims 1 and 62 wherein the initial stage of the interesterifying reaction is carried out in a continuous manner under conditions of backmixing suitable for maintaining within the reaction mixture a level of partial fatty acid esters of the polyol that is sufficient to emulsify the reaction mixture. Further, Appellants find no teaching or suggestion in Williamse EP '059 of a process as recited in claim 62, wherein a final stage of the interesterifying reaction is carried out in a continuous manner under conditions approaching plug-flow conditions after the degree of esterification of the polyol has reached about 50%.

The Examiner has cited the Balint et al, Seltzer and Mansour references based on their disclosures of continuous processes with backmixing and/or plug flow. In fact, Appellants

themselves cite Seltzer, Balint et al '368 and Mansour at pages 20-21 of the present specification as disclosing backmixing and/or plug-flow conditions. However, in the absence of this teaching in the present specification, one of ordinary skill in the art would have no motivation for combining any of the teachings of Balint et al, Seltzer or Mansour with the teachings of either Willemse '682 or Volpenhein. In this regard, Appellants note that Balint et al '461 and '368 are directed to processes for the preparation of linear condensation polyester polymers of high molecular weight and high quality for fiber, filament and film production (see, for example, Balint et al '461, column 2, lines 52-57). More specifically, Balint et al react ethylene glycol and terephthalic acid to form the linear high molecular weight polyester polymers. Appellants find no teaching or suggestion by Balint et al relating to a process for preparing highly esterified polyol fatty-acid polyester, particularly of sugar alcohols as taught by Willemse '682 and Volpenhein. Similarly, Appellants find no teaching or suggestion in either Balint reference which would motivate one of ordinary skill in the art to employ a continuous reaction scheme in the initial stage of the reaction taught by Willemse '682 or Volpenhein, particularly with backmixing suitable to maintain a level of partial fatty acid esters of the polyol reactant sufficient to emulsify the reaction mixture.

Seltzer is directed to an apparatus for preparing epoxidized organic compounds by reaction of a peracid epoxidizing agent and an unsaturated organic compound. However, Appellants find no teaching or suggestion by Seltzer relating to processes for the synthesis of highly esterified polyol fatty acid polyesters, particularly using a sugar polyol, as taught in Willemse '682 and Volpenhein. Similarly, Appellants find no teaching or suggestion in the Seltzer reference which would motivate one of ordinary skill in the art to employ a continuous reaction scheme in the initial stage of the reaction taught by Willemse '682 or Volpenhein, particularly with backmixing suitable to maintain a level of partial fatty acid esters of the polyol reactant sufficient to emulsify the reaction mixture.

Finally, Mansour discloses a mixing apparatus, for example for making polyester resins (column 3, line 1). However, Appellants find no teaching or suggestion relating to processes for preparing highly esterified polyol fatty acid polyesters as taught by either Willemse '682 or Volpenhein. Similarly, Appellants find no teaching or suggestion in the Mansour reference which would motivate one of ordinary skill in the art to employ a continuous reaction scheme in the initial stage of the reaction taught by Willemse '682 or Volpenhein, particularly with backmixing suitable to maintain a level of partial fatty acid esters of the polyol reactant sufficient to emulsify the reaction mixture.

Thus, there simply is no motivation in any of the cited references for combining their teachings along the lines asserted by the Examiner. While Balint et al, Seltzer and Mansour disclose continuous processes with back mixing and/or plug flow, Appellants find no teaching or suggestion in any of these references relating to a fatty acid ester-sugar polyol esterification reactions, or, importantly, for backmixing so as to maintain within a reaction mixture a level of partial fatty acid ester of the polyol reactant that is sufficient to emulsify the reaction mixture, as is required in the processes of claim 1 and 62. Additionally, Appellants find no teaching or suggestion in any of these references of such a process wherein a final stage of the interesterifying reaction may be carried out in a continuous manner under conditions approaching plug-flow conditions after the degree of transesterification of the polyol has reached about 50%, as further required by claim 62.

Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention absent some teaching, suggestion or incentive supporting the combination, *In re Geiger*, 2 U.S.P.Q.2d 1276, 1278 (Fed. Cir. 1987). Appellants find no such teaching, suggestion or incentive supporting the combination asserted by the Examiner. Thus, the cited combination of references does not render the presently claimed processes obvious under 35 U.S.C. §103. Accordingly, the rejection of claim 1, and claims 5, 6, 8, 9,

13 and 23 dependent thereon, and the rejection of claim 62 and claims 14, 15, 27, 28, 43-45, 48, 51, 54 and 55 dependent thereon, should be reversed.

C. Claims 8, 9 and 28 Are Independently Patentable

Claims 8 and 28 are directed to the process of claims 1 and 27, respectively, wherein, inter alia, the initial level of soap emulsifier is from about 0.2 to about 0.4 mole per mole of polyol. Claim 9 depends from claim 8. Appellants submit that the processes defined by these claims are independently patentably distinguishable from the cited combination of references.

That is, Willemse '682 broadly discloses that suitable amounts of emulsifier lay within the range of from 0.1 to 15% by weight (column 5, lines 27-30). However, Appellants find no teaching by Willemse '682 of any criticality of the molar ratio of soap emulsifier to polyol and particularly find no teaching of the molar ratios recited in claims 8 and 28. On the other hand, Volpenhein discloses that molar ratios of soap-polyol should be from about 0.6:1 to about 1:1, preferably from about 0.75:1 to about 1:1. Thus, while Willemse '682 provides no teaching of the subject matter of the limitations of claims 8 and 28, Volpenhein teaches away from the limitations of claim 8 and 28. Appellants find no teachings in any of the secondary references to resolve these deficiencies. As noted above, it is error to find obviousness where references diverge from and teach away from the invention at hand, *In re Fine, supra.* Thus, the processes of claim 8, claim 9 dependent thereon, and claim 28 are nonobvious over and patentably distinguishable from the cited combination of references. Accordingly, the rejection of claims 8, 9 and 28 should be reversed.

D. Claims 13, 43 and 51 Are Independently Patentable

Claims 13, 43 and 51 are directed to the processes of claims 1, 62 and 48, respectively, wherein the molar ratio of the total ester reactant to the esterifiable hydroxy group is from about 1:1 to about 1.2:1. As noted previously, both Willemse '682 and Volpenhein teach processes employing higher molar ratios of ester reactant to esterifiable

hydroxy groups. For example, Willemse '682 employ a ratio of at least 1.25:1 (column 4, lines 37-41) while Volpenhein teach a ratio of 1.5:1 (column 6, lines 54-55). Willemse EP '059 similarly teaches a ratio at least 1.25:1 (page 4, lines 13-15, fatty acid lower alkyl ester:sucrose ratio of 10:1), while the remaining references provide no teachings of these reactants or reaction.

In order to render a claimed invention obvious, the prior art must enable one skilled in the art to make and use the claimed invention, *Motorola, Inc. v. Interdigital Tech. Corp.*, 43 U.S.P.Q. 2d 1481, 1489 (Fed. Cir. 1997). In view of the deficiencies in the teachings of the primary references, and the failure of the second references to resolve these deficiencies, the cited combination of references does not enable one skilled in the art to make and use the processes of claims 13, 43 and 51 and therefore does not render these claims obvious. The rejection of claims 13, 43 and 51 should therefore be reversed.

E. Claims 14, 15, 28, 54 and 55 Are Independently Patentable

Claims 14, 15 and 28 further recite parameters of the back mixing process. Particularly, these claims recite that the conditions of back mixing are continued until the degree of esterification of the polyol is from about 20% to about 70% (claim 14), from about 35% to about 60% (claim 15), or from about 30% to about 60% (claim 28). Claims 54 and 55 depend from claim 14.

Appellants find no teaching or suggestion in either Willemse '682 or Volpenhein, or any of the secondary references relied upon by the Examiner, which provide any specific description of backmixing conditions for a fatty acid lower alkyl ester-polyol reaction, and particularly find not teaching or suggestion of the backmixing conditions as recited in any of claims 14, 15 or 28. Thus, the cited combination of references does not enable one of ordinary skill in the art to make and use the processes used in these claims and therefore does not render the processes of claims 14, or 54 and 55 dependent thereon, 15 or 28 obvious,

Motorola, Inc. v. Interdigital Tech. Corp., supra. The rejection of these claims under 35 U.S.C. §103 should therefore be reversed.

F. Claim 30 is Independently Patentable

Claim 30 depends from claim 62 and recites that the temperature in the initial stage is from about 132° C. to about 135° C. and the temperature in the subsequent stages is from about 100° C. to about 120° C. As set forth in the present specification, for example at page 18, beginning at line 6 and in Examples 4 and 16, the use of a lower temperature in the later stage of the reaction has surprisingly been found to minimize undesirable side reactions.

On the other hand, Willemse '682 discloses that both stages of the transesterification reaction can be carried out at a similar temperature although it has been found of advantage to raise slightly the temperature during the second stage of the reaction (column 3, lines 50-54). Volpenhein generally discloses that the first stage reaction is conducted at a temperature within a range from about 110° C. to 180° C. and the second stage of the reaction is conducted at a temperature from about 120° C. to about 160° C. (column 5, lines 34-35 and 56). Volpenhein exemplify conducting both stages of the reaction at 135° C. (Example 1, column 6, lines 50-51 and 55-56). Thus, both of the primary references relied upon by the Examiner teach away from a process as recited in claim 30 wherein the initial stage is conducted at a lower temperature of from about 100° C. to 120° C. The deficiencies of these primary references are not resolved by the secondary references as Willemse EP '059 provide no distinction in temperatures in different stages of a transesterification reaction (see, for example, page 5, lines 24-31 wherein the reaction is maintained at a temperature of 135° C), and the remaining references provide no teaching or suggestion as to temperature suitable for various stages of such a transesterification reaction.

Thus, at best, the references teach away from the limitations of claim 30. It is error to find obviousness where references diverge from and teach away from the invention at hand,

In re Fine, supra. Thus, the process of claim 30 is nonobvious over and patentably distinguishable from the cited combination of references. Accordingly, the rejection of claim 30 should be reversed.

G. Claims 48 and 51 Are Independently Patentable

According to claim 48, the final stages of the reaction in the process of claim 62 are carried out under plug-flow conditions, after the degree of esterification of said polyol has reached at least about 50%. Claim 51 depends from claim 48. As set forth in the specification, for example at page 19, lines 19-37 and page 21, lines 25-37, conducting the final stages under plug-flow conditions advantageously achieves high degrees of esterification while minimizing the time for more costly reaction conditions when the plug flow is conducted after the degree of esterification of the polyol has reached at least about 50%.

Appellants find no teaching or suggestion in Willemse '682 relating to a continuous process carried out under conditions of backmixing, and, specifically, wherein final stages of the interesterifying reaction are conducted under plug-flow conditions after the degree of esterification of the polyol has reached at least about 50%. Further, Appellants find no teaching or suggestion by Volpenhein relating to a continuous process, relating to conditions of backmixing, or relating to final stages of the interesterifying reaction as conducted under plug-flow conditions after the degree of esterification of the polyol has reached at least about 50%.

These deficiencies of Willemse '682 and Volpenhein are not resolved by Willemse EP '059, Balint et al, Seltzer or Mansour. As noted above, Willemse EP '059 does not provide any further teachings over Willemse '682 with respect to a continuous process. On the other hand, while Balint et al, Seltzer and Mansour disclose continuous processes, Appellants find no teaching or suggestion for employing any of the teachings of these references in the

production of highly esterified polyol fatty-acid polyester, and particularly for carrying out the final stages of the reaction process under plug-flow conditions, after the degree of esterification of said polyol has reached at least about 50%.

In view of the deficiencies of these references, the cited combination of references does not enable one of ordinary skill in the art to make and used the process of clam 48. Thus, the cited combination of references does not render the process of claim 48, or claim 51 dependent thereon, obvious under 35 U.S.C. §103, *Motorola, Inc. v. Interdigital Tech. Corp.*, *supra*. The rejection of claims 48 and 51 should therefore be reversed.

H. <u>Claims 54 and 55 Are Independently Patentable</u>

Claim 54 requires that the continuous process of claim 14 is carried out in a series of at least two reaction vessels, while claim 55 further recites that there are from three to about eight of the reaction vessels. As set forth in the present specification, for example at page 21, lines 13-22, it is advantageous to carry out the reaction in a series of reaction vessels in order to permit closer control over the various reaction parameters disclosed as desirable for obtaining high yield of highly esterified polyol product. Further, as shown in Example 16, a series of continuous reactors achieves fast and robust reactions with improved process economics and product quality.

Appellants find no teaching or suggestion by either Willemse '682 or Volpenhein for conducting a continuous process for preparing highly esterified polyol fatty acid polyester by interesterifying polyol containing more than four esterifiable hydroxy groups and fatty acid ester of an easily removable alcohol in a heterogeneous reaction mixture, wherein said easily removable alcohol is removed from said reaction mixture as the reaction proceeds, in at least two reaction vessels or in three to about eight reaction vessels. In fact, Appellants find no teaching or suggestion by either of these references for conducting an interesterifying reaction in anything other than a single reaction vessel. Moreover, the deficiencies of

Willemse '682 and Volpenhein are not resolved by Willemse EP '059, Balint et al, Seltzer or Mansour. EP '059 provides no additional teachings over Willemse '682 of a continuous process while the remaining secondary references provide no teaching or suggestion relating to a continuous process for preparing highly esterified polyol fatty acid polyester by interesterifying polyol containing more than four esterifiable hydroxy groups and fatty acid ester.

In view of the deficiencies of these references, the cited combination of references does not enable one of ordinary skill in the art to make and used the processes of clams 54 and 55. Thus, the cited combination of references does not render the processes of claims 54 and 55 obvious under 35 U.S.C. §103, *Motorola, Inc. v. Interdigital Tech. Corp., supra*. The rejection of claims 54 and 55 should therefore be reversed.

IV. CONCLUSIONS

Thus, the processes defined by independent claims 1 and 62, and claims 5, 6, 8, 9, 13-15, 23, 27, 28, 30, 43-45, 48, 51, 54 and 55 dependent thereon, are nonobvious over and patentably distinguishable from the combination of references cited by the Examiner. Accordingly, the rejection under 35 U.S.C. §103(a) should be reversed. Favorable action by the Board is respectfully requested.

Respectfully submitted,

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APPENDIX

1. A continuous process for preparing highly esterified polyol fatty-acid polyester by interesterifying polyol containing more than about four esterifiable hydroxy groups and fatty-acid ester of easily removable alcohol in a heterogeneous reaction mixture wherein

a) a catalyst is used in the reaction mixture at an initial level of from about 0.01 to about 0.5 mole of catalyst per mole of polyol;

b) a soap emulsifier is used in the initial stage of the process at a level of from about 0.001 to about 0.6 mole of soap per mole of polyol;

c) the molar ratio of total ester reactant to each esterifiable hydroxy group of the polyol in the reaction mixture ranges from about 0.9:1 to about 1.2:1;

d) the temperature in the initial stage of the process ranges from about 130°C to about 140°C, and in the final stages of the process ranges from about 80°C to about 120°C; and

e) easily removable alcohol is removed from the reaction mixture as the interesterifying reaction proceeds; and

wherein the initial stage of the interesterifying reaction is carried out in a continuous manner under conditions of backmixing suitable for maintaining within said reaction mixture a level of lower partial fatty acid esters of said polyol that is sufficient to emulsify said reaction mixture.

5. The process of Claim 1 in which the initial catalyst level is from about 0.01 to about 0.1 mole of catalyst per mole of polyol.

6. The process of Claim 5 in which the catalyst level is from about 0.02 to about 0.05 mole of catalyst per mole of polyol.

8. The process of Claim 1 wherein said initial level of soap emulsifier is from about 0.2 to about 0.4 mole per mole of polyol.

9. The process of Claim 8 wherein said soap emulsifier is a potassium soap of hydrogenated fatty acid containing from about 10 to about 22 carbon atoms.

13. The process of Claim 1 wherein said molar ratio of said total ester reactant to said esterifiable hydroxyl group is from about 1:1 to about 1.2:1.

14. The process of Claim 62 wherein the initial stage of said interesterifying reaction is carried out under conditions of backmixing until the average degree of esterification of the polyol is from about 20% to about 70%, to thereby provide sufficient lower partial polyol polyester to aid in solubilization of the polyol.

15. The process of Claim 14 wherein the initial stage of said interesterifying reaction is carried out under conditions of backmixing until the average degree of esterification of the polyol is from about 35% to about 60%.

23. The process of Claim 1, wherein the temperature in said initial stage is between about 132°C and about 135°C.

27. The process of Claim 62 wherein, in the initial stage of the interesterifying reaction, the reaction mixture contains soap emulsifier at a level of from about 0.001 to about 0.6 mole per mole of polyol.

28. The process of Claim 27 wherein said soap emulsifier is at a level of from about 0.2 to about 0.4 mole per mole of polyol and said conditions of backmixing are continued until the degree of esterification of said polyol is from about 30% to about 60%.

30. The process of Claim 62 wherein the temperature in the initial stage is from about 132°C to about 135°C and the temperature in the subsequent stages is from about 100°C to about 120°C.

43. The process of Claim 62 wherein said molar ratio of said total ester reactant to each said esterifiable hydroxyl group is from about 1:1 to about 1.2:1.

44. The process of Claim 62 wherein the final degree of esterification of said polyol reaches at least about 70%.

45. The process of Claim 44 wherein the final average degree of esterification of the polyol is at least about 95%.

48. The process of Claim 27 wherein the final stages of the reaction are carried out under plug-flow conditions, after the degree of esterification of said polyol has reached at least about 50%.

51. The process of Claim 48 wherein the molar ratio of said total ester reactant to each said esterifiable hydroxyl group of said polyol is from about 1:1 to about 1.2:1.

54. The process of Claim 14 which is carried out in a series of at least two reaction vessels.

55. The process of Claim 54 wherein there are from three to about eight of said reaction vessels.

62. In a continuous process for preparing highly esterified polyol fatty acid polyester by interesterifying polyol containing more than four esterifiable hydroxyl groups and fatty acid ester of an easily removable alcohol in a heterogeneous reaction mixture wherein said easily removable alcohol is removed from said reaction mixture as the reaction proceeds, the improvement which comprises:

(A) carrying out an initial stage of the interesterifying reaction in a continuous manner under conditions of backmixing suitable for maintaining within said reaction mixture a level of lower partial fatty acid esters of said polyol that is sufficient to emulsify said reaction mixture; and

(B) carrying out at least a final stage of the interesterifying reaction in a continuous manner under conditions approaching plug-flow conditions after the degree of esterification of said polyol has reached at least about 50%.

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